IEC 62056-8-6

Edition 1.0 2017-04

INTERNATIONAL STANDARD

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colour inside

Electricity metering data exchange – The DLMS/COSEM suite – Part 8-6: High speed PLC ISO/IEC 12139-1 profile for neighbourhood networks

Échange des données de comptage de l'électricité – La suite DLMS/COSEM – Partie 8-6: Profil CPL ISO/IEC 12139-1 à grande vitesse pour les réseaux de voisinage

IEC 62056-8-6:2017-04(en-fr)

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INTERNATIONAL
ELECTROTECHNICAL
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INTERNATIONALE

ICS 17.220; 35.110; 91.140.50

ISBN 978-2-8322-4150-9

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FOREWORD

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FDIS	Report on voting
13/1730/FDIS	13/1741/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62056 series, published under the general title *Electricity metering data exchange – The DLMS/COSEM suite*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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INTRODUCTION

As defined in IEC 62056-1-0, the IEC 62056 DLMS/COSEM suite provides specific communication profile standards for communication media relevant for smart metering.

Such communication profile standards specify how the COSEM data model and the DLMS/COSEM application layer can be used on the lower, communication media-specific protocol layers.

Communication profile standards refer to communication standards that are part of the IEC 62056 DLMS/COSEM suite or to any other open communication standard.

This document specifies the DLMS/COSEM profile for High Speed PLC (HS-PLC) technologies according to ISO/IEC 12139-1 for neighbourhood networks. The technology is based on Discrete Multi-Tone (DMT) modulation. It may be used in low voltage or on medium voltage distribution networks. The PHY rate of High Speed PLC is typically 24 Mbps, however the data throughput varies according to many aspects of low voltage or medium voltage power lines. Although High Speed PLC can be used both on low voltage and medium voltage networks, in this document HS-PLC on low voltage network is only considered.

When implementing advanced services based on DLMS/COSEM profiles such as complex tariff programs, data security measures, two-way consumption data exchange for demand response and so forth, the neighbourhood network may become a bottleneck. The HS-PLC technology minimizes such bottlenecks due to the high data rates available. Moreover, the HS-PLC technology can accommodate increased amounts of data thus it can additionally support other applications such as Internet of Things (IoT).

Using the high speed PLC technology specified in ISO/IEC 12139-1 may be subject to national regulations. However, this aspect is outside the Scope of this document.

ELECTRICITY METERING DATA EXCHANGE – THE DLMS/COSEM SUITE –

Part 8-6: High speed PLC ISO/IEC 12139-1 profile for neighbourhood networks

1 Scope

This part of IEC 62056 specifies the DLMS/COSEM communication profile for ISO/IEC 12139-1 High speed PLC (HS-PLC) neighbourhood networks.

It uses the standard ISO/IEC 12139-1 established by ISO/IEC JTC1 SC06.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62056-1-0:2014, *Electricity metering data exchange – The DLMS/COSEM suite – Part 1-0: Smart metering standardisation framework*

IEC TS 62056-1-1:2016, *Electricity metering data exchange – The DLMS/COSEM suite – Part 1-1: Template for DLMS/COSEM communication profile standards*

IEC 62056-46, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 46: Data link layer using HDLC protocol*

IEC 62056-4-7, *Electricity metering data exchange – The DLMS/COSEM suite – Part 4-7: DLMS/COSEM transport layer for IP networks*

IEC 62056-5-3, *Electricity metering data exchange – The DLMS/COSEM suite – Part 5-3: DLMS/COSEM application layer*

IEC 62056-6-1, *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-1: Object Identification System (OBIS)*

IEC 62056-6-2:2016, *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-2: COSEM interface classes*

IEC 62056-7-6, *Electricity metering data exchange – The DLMS/COSEM suite – Part 7-6: The 3-layer, connection-oriented HDLC based communication profile*

IEC 62056-9-7, *Electricity metering data exchange – The DLMS/COSEM suite – Part 9-7: Communication profile for TCP-UDP/IP networks*

ISO/IEC/IEEE 8802:2014*, Standard for Ethernet*

ISO/IEC 12139-1:2009, *Information technology – Telecommunications and information exchange between systems – Power line communication (PLC) – High speed PLC medium access control (MAC) and physical layer (PHY) – Part 1: General requirements*

RFC 791, *Internet Protocol, DARPA internet program protocol specification, 1981*

RFC 1144, *Compressing TCP/IP Headers for Low-Speed Serial Links, 1990*

RFC 2460, *Internet Protocol, Version 6 (IPv6) Specification, 1998*

RFC 2508, *Compressing IP/UDP/RTP Headers for Low-Speed Serial Links, 1999*

RFC 3095, *RObust Header Compression (ROHC): Framework and four profiles: RTP, UDP, ESP, and uncompressed, 2001*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
adaptation layer
supporting layer between PHY/MAC layer of ISO/IEC 12139-1 and upper layer

3.2 Abbreviated terms

AA	Application Association
ADPL	Adaptation Layer
APDU	Application Layer Protocol Data Unit
CMD	Command
COSEM	Companion Specification for Energy Metering
CPAS	Common Part Adaptation Sublayer
DLMS	Device Language Message Specification
DMT	Discrete Multi-Tone
HDLC	High-level Data Link Control
HES	Head End System
HS-PLC	High Speed Power Line Communication
IC	Interface Class
IoT	Internet of Things
IP	Internet Protocol
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
LLC	Logical Link Control
LN	Local Network
LNAP	Local Network Access Points
MAC	Medium Access Control
MPDU	MAC Protocol Data Unit

NN	Neighbourhood Network
NNAP	Neighbourhood Network Access Points
PDU	Protocol Data Unit
PHY	Physical Layer
PLC	Power Line Communication
SAP	Service Access Point
SSAS	Service Specific Adaptation Sublayer
STA	Status

4 Targeted communication environments

The DLMS/COSEM High speed PLC (HS-PLC) ISO/IEC 12139-1 profile is intended for remote data exchange on Neighbourhood Networks (NN) between Neighbourhood Network Access Points (NNAPs) and metering devices or Local Network Access Points (LNAPs) using HS-PLC technology over the low voltage electricity distribution network as a communication medium. The functional reference architecture is shown in Figure 1.

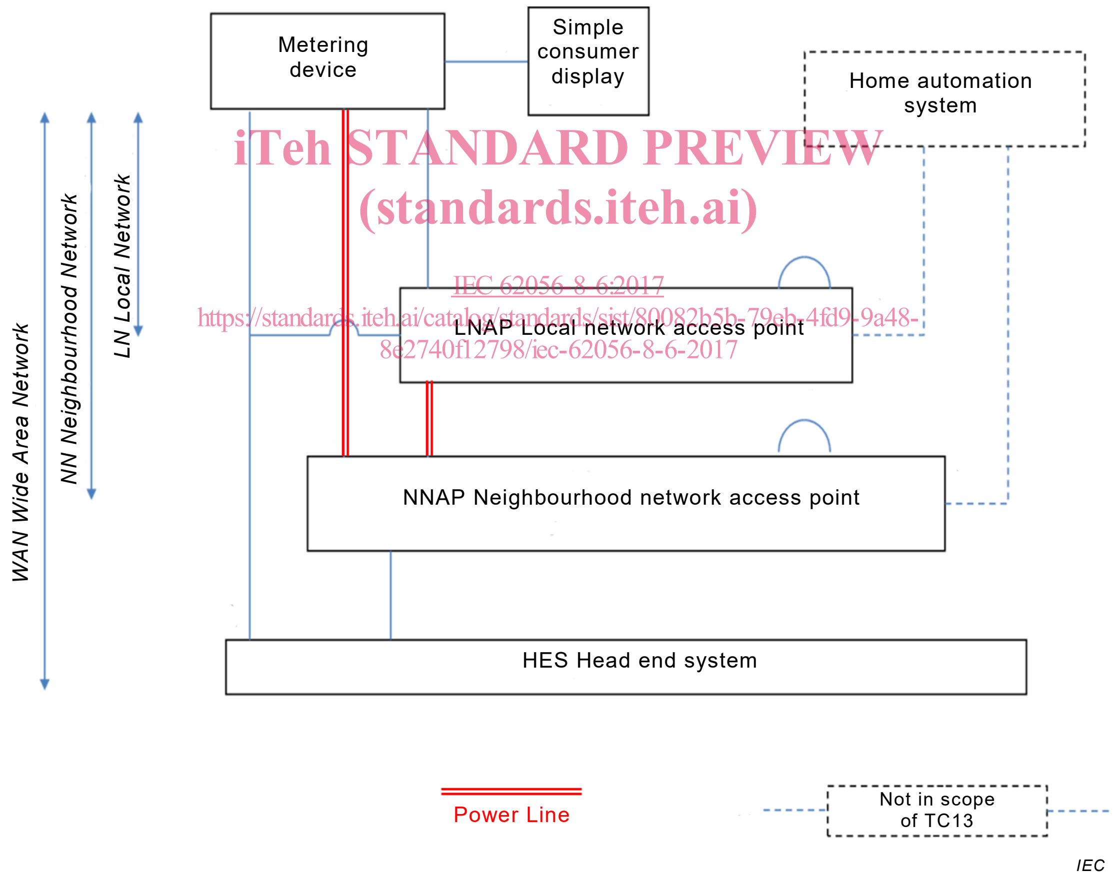

Figure 1 – Entities and interfaces of a smart metering system using the terminology of IEC 62056-1-0

Metering devices – typically electricity meters – comprise application functions and communication functions. They may be connected directly to the NNAP via the C interface, or to an LNAP via the M interface, while the LNAP is connected to the NNAP via the C interface. The LNAP function may be co-located with the metering functions.

A NNAP comprises gateway functions and it may comprise concentrator functions. Upstream, it is connected to the metering Head End System (HES) using suitable communication media and protocols.

Metering devices and LNAPs may communicate to different NNAPs, but to one NNAP only at a time.

NNAPs and similarly LNAPs may communicate to each other, but it is out of the scope of this document, which covers the C interface only.

When an NNAP has concentrator function it acts as a DLMS/COSEM client. When an NNAP has gateway function only the HES acts as a DLMS/COSEM client. Metering devices or LNAPs act as the DLMS/COSEM servers.

5 Use of the communication layers for this profile

5.1 Information related to the use of the standard specifying the lower layers

This communication profile uses the services of the PHY and MAC layers according to ISO/IEC 12139-1:2009.More details can be found in 5.3.2 and 5.3.3.

5.2 Structure of the communication profile

The structure of this profile is shown in Figure 2. The adaptation layer supports the connection of the DLMS/COSEM application layer to the MAC layer of ISO/IEC 12139-1:2009 via an HDLC based data link layer or via an IP based network layer. The adaptation layer described in 5.4 supports both options. Devices implementing this standard may support just one or the other option.

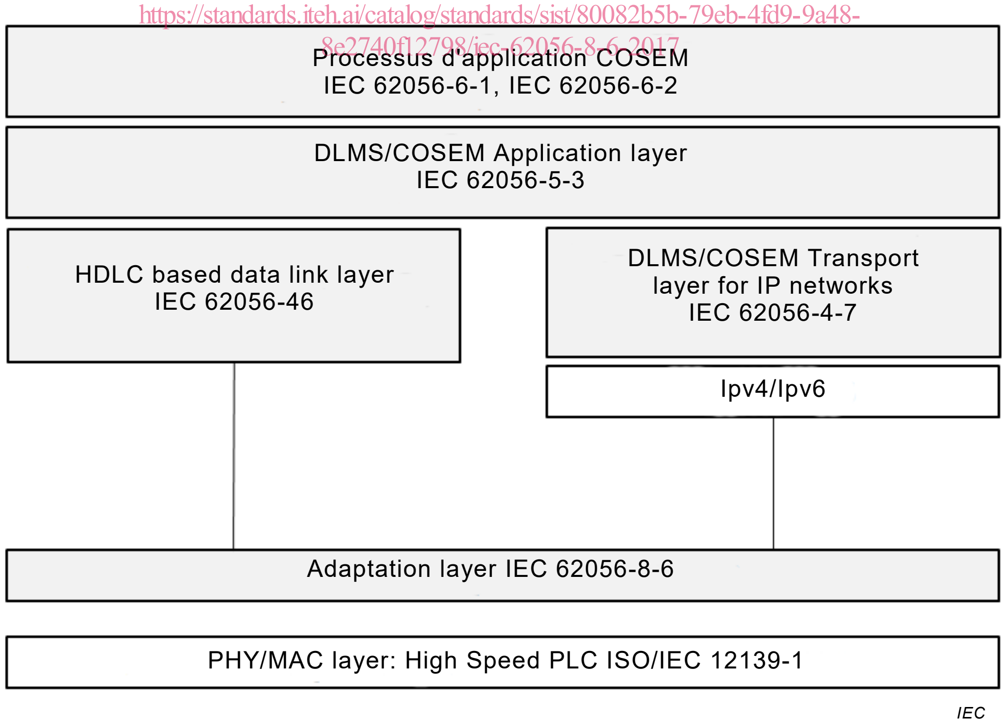

Figure 2 – DLMS/COSEM High Speed PLC profile

5.3 Lower protocol layers and their use

5.3.1 Overview

Lower protocol layers of this profile consist of the physical layer and the MAC layer. They are specified in ISO/IEC 12139-1:2009.

5.3.2 Physical layer

The physical layer provides the interface between the equipment and the physical transmission medium that is the electricity distribution network. It transmits and receives MPDUs between neighbour nodes by using the PLC technology defined in ISO/IEC 12139-1:2009. It uses Discrete Multi-Tone (DMT) modulation in the frequency range from 2,15 MHz up to 23,15 MHz and each tone has a bandwidth of 97,65625 kHz (theoretical) with the exception of the bandwidth designated as the guard band in accordance with each national regulation.

More details of the physical layer are specified in ISO/IEC 12139-1:2009, Clause 6.

5.3.3 MAC layer

The MAC layer handles access to the physical medium and physical device addressing. The MAC layer of this profile is specified in ISO/IEC 12139-1:2009, Clause 7.

5.4 Service mapping and adaptation layers

5.4.1 Overview

The adaptation layer takes a role of effectively transmitting the HDLC based data link layer frames, IPv4 (RFC 791) or IPv6 (RFC 2460) packets based on relevant specifications in IEC 62056-46 or IEC 62056-4-7. The adaptation layer is connected to the MAC layer and to the HDLC based data link layer or IPv4/IPv6 layer. It is composed of a Common Part Adaptation Sublayer (CPAS) and a Service Specific Adaptation Sublayer (SSAS). The SSAS has two types: IP Service Specific Adaptation Sublayer (IP SSAS) and HDLC Service Specific Adaptation Sublayer (HDLC SSAS). The architecture of the adaptation sublayers is shown in Figure 3.

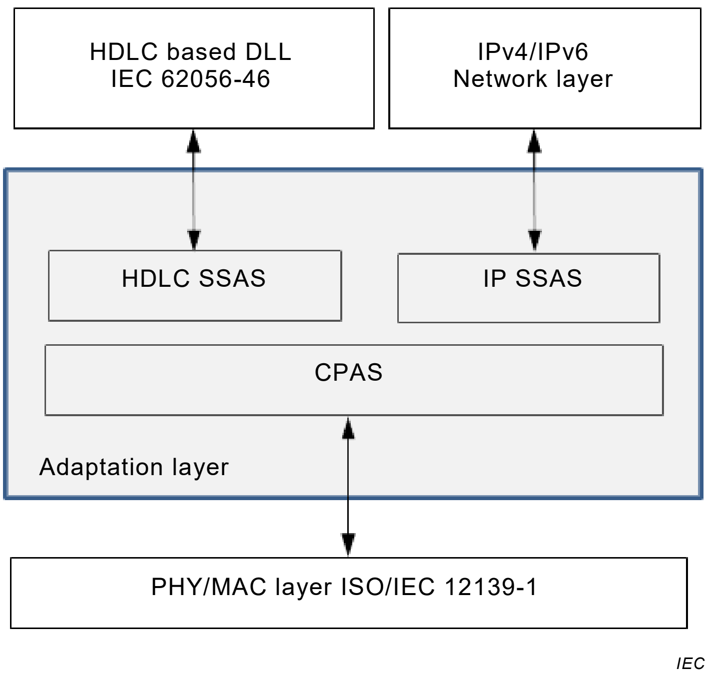

Figure 3 – Adaptation layer architecture

5.4.2 CPAS

The CPAS transports a SSAS message (as payload) by adding a header to it. The SSAS message may consist of an IP SSAS packet (assembled by the IP SSAS) or of a HDLC SSAS frame (assembled by the HDLC SSAS). The structure of the CPAS frame is shown in Figure 4. It corresponds to an Ethernet frame according to ISO/IEC/IEEE 8802:2014, where:

- DA is the destination CPAS address;
- SA is the source CPAS address;
- EtherType is used to identify the packet/frame type which is transported in the SSAS message:
  - IPv4: 0x0800;
  - IPv6: 0x86DD;
  - HDLC: project specific assignment.

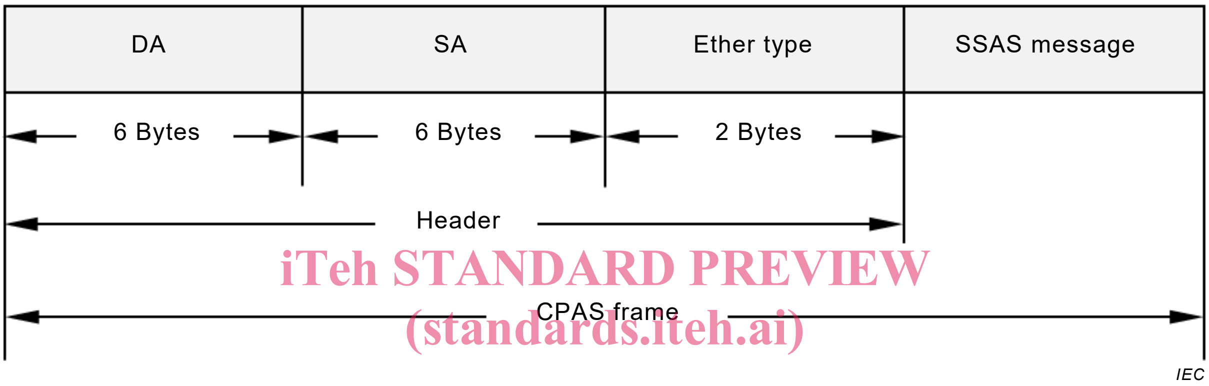

Figure 4 – CPAS frame structure

The mapping between IP addresses/HDLC addresses and CPAS DA/SA is supported by the IP SSAS or the HDLC SSAS as applicable. The details of the mapping procedure are implementation specific.

5.4.3 IP SSAS

5.4.3.1 Overview

The IP SSAS manages the mapping of IP packets to IP SSAS packets to be transported in the SSAS message field of the CPAS frame; see Figure 4. There are two different types of IP SSAS packets: the IP SSAS data packet (see 5.4.3.4) and the IP SSAS control packet (see 5.4.3.3).

The IP SSAS manages the mapping of IP packets to CPAS frames. In particular, the IP SSAS performs the following functions:

- Address resolution: Mapping the IP addresses to the CPAS addresses.

5.4.3.2 IP header compression

A lot of IP header compression related technologies have been developed. The most popular ones are Van Jacobson header compression (RFC 1144), IP header compression (RFC 2508) and ROHC (RFC 3095). Since the IP header compression related technologies are processed in the IP layer, IP SSAS does not take care of those technologies. Nonetheless the IP SSAS, at least, needs to recognize IP version of the received IP packet and determine whether the compression will be applied or not by using IP_Header_Comp_Type field defined in Table 3.

5.4.3.3 IP SSAS control packet

The IP SSAS control packet is used for address resolution and it is configured as specified in Figure 5 and Table 1.

Octets	1	1	1	4 or 16	16	4 or 16	16
	Packet_ Type	CTL_ Type	IP_ Len	Sender_ IP_ADDR	Sender_ CPAS_ADDR	Target_ IP_ADDR	Target_ CPAS_ADDR

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Figure 5 – IP SSAS control packet

Table 1 – IP SSAS control packet format Inconsistencies! IP_Len

Name	Length (octets)	Data type	Description
Packet_Type	1	enum	0x02: IPv4 Control packet of IP SSAS 0x03: IPv6 Control packet of IP SSAS
CTL_Type	1	enum	0x00: AR_Request_CMD 0x01: AR_Response_CMD
Sender_IP_ADDR	4 or 16	long-unsigned	Sender's IP address
Sender_CPAS_ADDR	6	long-unsigned	Sender's CPAS address
Target_IP_ADDR	4 or 16	long-unsigned	Target's IP address
Target_CPAS_ADDR	16	long-unsigned	Target's CPAS address

- In case of AR_Request_CMD requesting Address Resolution, CTL_Type is set to 0x00. In case of AR_Response_CMD responding to the request, CTL_Type is set to 0x01;
- AR_Request_CMD packet is generated when the sender node has the IP address of the target node, but does not know the CPAS address of the target node. The sender node that generates the AR_Request_CMD packet puts its information into the Sender_IP_Len, Sender_IP_ADDR, Sender_CPAS_ADDR fields and puts the target node's IP address information into the Target_IP_Len and Target_IP_ADDR fields. The Target_CPAS_ADDR field which the sender node tries to find out is filled with a series of 0xFFs;
- The target node which received the AR_Request_CMD packet responds with AR_Response_CMD packet putting its CPAS address into the Target_CPAS_ADDR field. This time, all the other address fields except for the Target_CPAS_ADDR, such as the Sender_IP_Len, Sender_IP_ADDR, Sender_CPAS_ADDR, Target_IP_Len, Target_IP, ADDR, are filled with the same values from the AR_Request_CMD packet;
- AR_Request_CMD packet is transmitted in broadcast mode;
- AR_Response_CMD packet is transmitted in unicast mode.

5.4.3.4 IP SSAS data packet

The IP SSAS data packet is used to transport the IP Packets received from the IPv4/IPv6 network layer. The structure is shown in Figure 6 and Table 2.

Octets	1	1	2	N
	Packet_Type	Comp_Type	IP_Data_Len	IP_Data

IEC

Figure 6 – IP SSAS data packet